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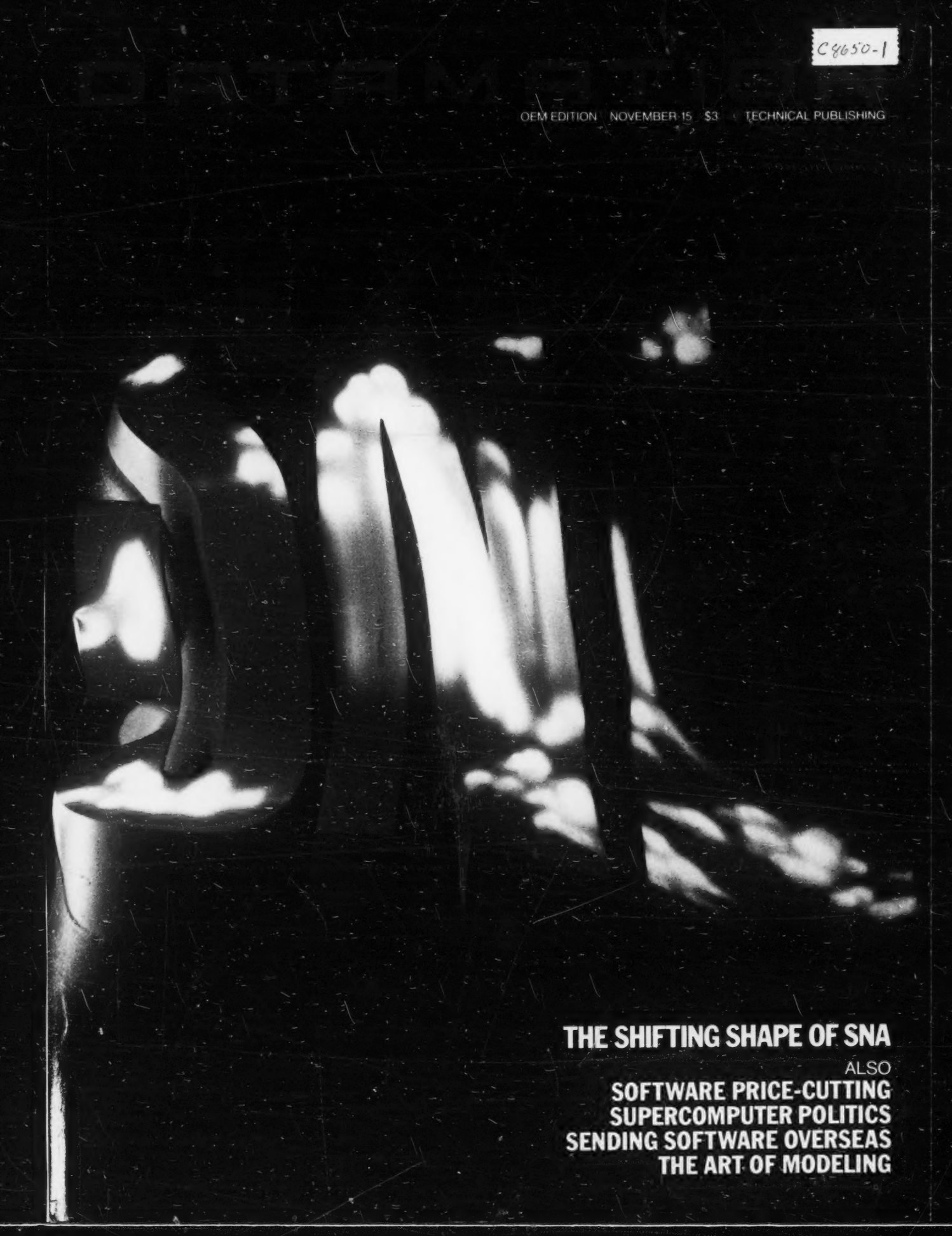

THE SHIFTING SHAPE OF SNA

ALSO

SOFTWARE PRICE-CUTTING
SUPERCOMPUTER POLITICS
SENDING SOFTWARE OVERSEAS
THE ART OF MODELING

DATAMATION

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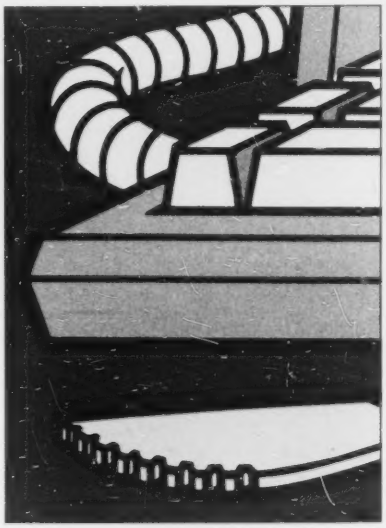

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COVER PHOTOGRAPH BY JAMES JOERN; 3-D ILLUSTRATION BY KATHY JEFFERS

OEM EDITION

Computers use a cornucopia of technologies to deliver their messages.

OUTPUT DEVICES

DISPLAYS
by Lamont Wood

It's easy enough to take displays for granted; they've served as the user's window into the computer system for as long as computers have been around. With a $4 billion installed value in the United States, today's terminal market is certainly mature, suggests Bob Sanekoff, a vice president with San Jose-based Dataquest Inc.

But new developments in these devices are cause for vars to sit up and take note. Innovative flat-panel screens on the market and the drawing board may better suit the needs of particular vertical markets. The alternative must be evaluated carefully, however, for each display technology has its drawbacks. Further, because the technology is new, its installed base value is less than $100 million, and perhaps not even $50 million, Sanekoff estimates.

The technology that seems to get the most attention is the gas plasma screen, which offers a display like a crt but is only an inch thick. Basically, gas plasma displays are neon lights in the form of flat panels rather than tubes. A grid of (transparent) electrodes is laid on either side of the glass, and wherever a horizontal line on one side and a vertical line on the other are both charged, the gas between them is ionized and starts to glow, creating a pixel (picture element) of light.

The industry is divided between alternating current (AC) panel makers, who are in the U.S., and direct current (DC) panel manufacturers, all in Japan. Donald Wedding Sr., president and chairman of one of the AC firms—Photonics Technology Inc. of Norwood, Ohio—predicts that AC panels will probably end up being used principally by the military, while DC panels will be used in commercial systems.

DC panels use mercury, a poison, so the military is nervous about putting them in submarines and tanks where they could leak into a confined space, Wedding explains. While the circuit drivers for DC systems are simpler and cheaper, making them more suitable for commercial use, the AC panels tend to be designed for large displays. And while AC panels have an expected life of over 20,000 hours, "it's under 10,000 for DC panels," Wedding adds, "and probably under 5,000."

The main trend in the gas plasma industry is vertical integration, with manufacturers providing the whole terminal rather than just the display panel, comments Joe Hoehn, manager of advanced programs at another AC plasma vendor, Electro-Plasma Inc. of Millbury, Ohio. At Lucitron Inc. in Northbrook, Ill., meanwhile, engineers are developing a gas plasma screen that actually works more like a crt. Alan Sobel, vp of operations, says his company can build not only any color screen (gas plasma screens are usually pink), but displays with gray scales, as well.

Instead of exciting neon to create points of light, Lucitron's grid excites the gas to emit electrons, which beat against a phosphor screen. The screen, in turn, emits light, just as a crt's screen does. "It's as if we had an electron gun for each dot on the screen," says Sobel. A gray scale can be produced by placing another charged grid between the first grid and the phosphor to control the flow of electrons.

Founded by a group of Zenith expatriates in 1978, Lucitron is just now glimpsing pay dirt, Sobel adds. The firm expects to start shipping demonstration units of its screen next year. The Lucitron official anticipates the "gas electron phosphor" display will find its niche replacing projection crts for group viewing, since the new technology lends itself to large screens.

In direct competition with gas plasma displays are electroluminescent (EL) displays. This industry seems to have a northern orientation, since the three firms that make EL displays are Sharp in Japan, a company called Lojha in Finland, and Planar Systems Inc. of Beaverton, Ore.

EL USES SOLID PHOSPHOR

Like gas plasma, EL uses an electrode grid to charge individual pixels. But instead of neon gas, the active material is solid electroluminescent phospor. Planar spokeswoman Kim Langeler says the company's standard

ILLUSTRATION BY JANE STERRETT

Gas plasma displays are getting most of the industry's attention.

product has a resolution of 512 by 256 pixels, with a 640-by-200 or 640-by-400 screen available on custom order. The 640-by-400 screen is essential for IBM PC compatibility.

EL uses less power and is more rugged than gas plasma and won't freeze in the cold or collapse under high atmospheric pressure as liquid crystal displays (LCDs) may, says Langeler. But she adds that all EL makers have experienced problems achieving volume production, since the panels have to be made in "clean rooms." Planar's customers include the major automakers, which use them for dashboard displays, and the military. In fact, Planar, a spin-off of Tektronix Inc., has an R&D contract from the U.S. Army to develop multicolor EL displays for Army vehicles.

Grid Systems Corp. of Mountain View, Calif., also uses an EL display from Planar in its Compass portable computer, as well as a Japanese gas display in one version of its GridCase portable. "In terms of technical specifications, EL and gas plasma are fairly close," says Tom Humphries, hardware product marketing manager at Grid.

"They both have high contrast and a wide viewing angle. But, all things being equal, I think most people would prefer EL, since it has crisper dots," he says.

Grid chose EL for the Compass in 1982. At the time, the technology offered a resolution of 320 by 240 pixels; this was later increased to 512 by 256. When the time came to design the GridCase, "the people with plasma had the right format, price, and resolution," Humphries recalls. The GridCase also offers an enhanced LCD screen using blue-green letters on a yellow background. But even though the gas plasma version costs $600 more, it outsells the LCD version by a two-to-one margin, he notes.

Two of the principal objections to liquid crystal displays are that they have a narrow viewing angle and a slow response time. At Panelvision, a division of Litton Systems Inc. in Pittsburgh, engineers have addressed these objections with "thin-film transistor liquid crystal" (TFT LC) technology.

Tom Maloney, Panelvision marketing manager, explains that the basic idea is to put transparent electrodes on a glass substrate and cover an LCD screen with it. This allows each LCD pixel to be directly connected to its own capacitor. Since dynamic random-access memory (DRAM) circuits have a capacitor for each bit, he likens TFT to a screen-sized DRAM that allows you to see the state of the memory at a glance.

The TFT arrangement allows the liquid crystal to be "saturated" with current, improving viewing angle and response time. Panelvision was formed in November 1980 and acquired by Litton last June. The firm hopes to have a 640-by-400 display ready next year, and is already shipping panels with lower resolution.

Zetec Inc. of Issaquah, Wash., is using Panelvision's TFT display in a portable metal scanner for the aviation industry. "Current LCDs just have so many drawbacks," says Pat Spencer, Zetec's director of engineering. "We needed low power for safety [due to the presence of explosive fumes] and a battery that would last eight hours without two Sherpas to carry it," Spencer adds. Zetec also required a high response time for its scanner—an MIZ20 Eddy Current Instrument device. The TFT display must still be lit for visibility in the dark, however, since it depends on ambient lighting.

As far as plain old liquid crystals are concerned, the action is centered around color. Larry Tannas, a consultant in Orange, Calif., and author of *Flat Panel Displays and Crts* from Van Nostrand Reinhold, notes that there are about 12 companies working on color LCDs—all in Japan. Two-inch color LCD tv sets are already on the market. The sets are two inches across, says Tannas, because "if they were any larger, you'd see how poor the resolution really is"—half the standard tv resolution. The Japanese predict, however, that they will have acceptable eight or 10-inch sets within two years. Color LCDs, incidentally, also involve TFT technology.

CRT ALSO GETS A FACELIFT

New developments are not restricted to flat-panel displays. The computer industry's old friend, the crt, is also undergoing a facelift, especially at Azuray Inc. in Scotts Valley, Calif. The two-year-old company recently began shipments of a crt with a resolution of 2,048 by 2,048 lines.

Bill Fenley, Azuray's president, explains that a conventional crt would need a bandwidth of about 400MHz to achieve that resolution. But the Azuray 2000 B/W accomplishes it with 50MHz using multibeam tube technology. The tube has eight electron guns, each of which scans the entire screen in parallel with the others, eight lines apart. The screens are regular size, with 17 and 19 inches being popular, says Fenley.

One of Azuray's first customers is Matrix Instruments Inc. of Orangeburg, N.Y., which makes parts for CAT and other medical scanners. "Azuray offers something that is otherwise unavailable—it's the difference between a useful picture and something that might just be pretty," says Bruce Laskin, vice president of strategic planning at Matrix.

"We wanted eight bits of gray scale, a 60Hz refresh rate to avoid flicker, and high resolution," he says. "We had found that 1,200 lines was not enough for diagnostic quality. Other vendors could barely manage 2,000 lines and had maybe only two bits of gray scale. But at 2,000 lines, Azuray is just starting out at the low end—they can add more guns if needed," comments Laskin.

As for quality, Laskin says his company has had doctors walk up to a display and try to peel off what they assumed was an X-ray taped to the screen. As much as 25% of modern radiological procedures involve digital scanning methods such as CAT scans and nuclear resonance scans, creating an obvious market for high-resolution crts, he notes.

Other possible display technologies include electrophoretic and electrochromic displays. Tannas explains that the first of these technologies involves using electrostatic fields to arrange dye particles suspended in a liquid. Electrochromic technology uses chemicals that change color when charged. But Tannas notes that little has been published on either technology in the last several years, indicating a lack of interest. ◉

FIG. 1

PERCENT OF VARS SELLING SPECIFIC OUTPUT DEVICES

	AS OF MARCH 1985	BY YEAR-END 1986
Touch display	11.4	24.5
Color plotters	29.5	44.1
Color printers	24.2	49.8
Voice output	8.9	27.7

Source: Based on a survey sample of 1,189 resellers conducted by the Yankee Group.

Lamont Wood is a free-lance writer based in San Antonio.

As prices drop, more vars consider incorporating voice in their products for vertical markets.

VOICE DEVICES
by Esther Surden

When it surveyed 1,189 value-added resellers in March, the Boston-based research organization, the Yankee Group, got a surprise. Some 27.7% of the respondents expected to attach voice-output devices to their equipment by year-end 1986, compared with only 8.9% who do so today. Similar numbers of vars expected to incorporate voice output's sister technology, voice recognition, into their computers within the same time frame.

Although the Yankee Group survey did not explore how the vars planned to use voice output, the expected tripling of that market came as a shock to Yankee analyst Michael Goulde, who says he believes the vars are anticipating more from voice technology than they should reasonably expect. Similarly, consultants specializing in this field tend to be skeptical about the real growth potential for the voice-output market in the future.

There's no such pessimism from the manufacturers, however. One manufacturer, Votan, of Fremont, Calif., citing anonymous "independent market research firms," says that speech technology product sales will increase to $750 million a year by 1987 and predicts that during this decade, "verbal interaction with computers will become the rule rather than the exception."

Judging by the publicity they are putting out, both Digital Equipment Corp. and Texas Instruments—the two most vocal makers of voice equipment—are hot on the potential of this relatively new product, especially now that voice-output devices for personal computers are available. While DEC has stayed primarily with direct sales of its $4,000 DECtalk device, which uses an ASCII interface to hook up to any computer, Texas Instruments, for one, sees the value-added reseller as a natural way to market its IBM PC-compatible device, which sells for $995 and comes complete with a host of development tools.

Several relatively new companies are courting vars as well. Votan, in the market since 1982, and Roswell, Ga.-based Innovative Technology Inc.—both of which have developed peripheral circuit boards and software for IBM PCs and compatibles—are asking vars to design related voice applications for their units. In single-unit quantities, ITI's Nita product costs $1,995. An applications development kit runs another $500. Supplying both speech input and output devices, Votan offers its VPC 2000 plug-in card for the IBM PC for $2,450 in single-unit quantities, a price that includes telephone management software.

Current generation voice-output devices generally come in two flavors—digitized voice and voice synthesis. Digitized voice converts spoken words into information that can be stored, retrieved, and replayed by a computer system and is similar to tape recording. Before digitized voice could become economical, researchers had to work on voice compression software techniques that allow only key features of speech to be stored on computer disk so as not to take up too much room. Thus, speech normally transmitted at 64Kbps can be compressed to 2,400bps and played back so that it sounds intelligible. Texas Instruments is the key developer of the TMS320 signal processing chip, which has been used in many of these devices.

Voice synthesis converts ordinary ASCII text into understandable speech, so that particular information from a database can be "read" to a user over the phone. While digitized voice relies on prerecorded messages or phrases, voice synthesis systems use linguistic pronunciation rules to create speech, and thus requires many hours of basic linguistic research before understandable speech can be created.

Larry Drinkwater, DEC's marketing manager for voice technologies, notes that the intelligibility of synthesis devices has improved over the past few years, making synthesis a viable product in today's marketplace.

NOT ALL SEE ROSY FUTURE

While all the companies are quick to cite situations in which vars could fit their systems with voice, not all industry observers believe that the market for voice output has much place to go in the near future. Amy Wohl, an office automation consultant based in Bala Cynwyd, Pa., says, "All the applications in the office in which a computer talks back to the user depend on the system's ability to mimic natural speech. It's not real interesting when it's just reading you something out of a vocabulary of a few hundred words." Much software has to be written and many breakthroughs in the cost of high-level processing will have to take place before these kinds of applications will be commercially feasible, Wohl suggests.

Dan Carter, vice president of the strategic business service unit at Walter Ulrich Consulting of Houston, agrees there are many office applications in the distant future. He adds, however, that the most promising areas of use for voice systems are those in which both eyes and hands are busy—airline pilots during certain landing procedures and inspectors of industrial systems are two examples. In the latter, voice output and voice input are combined to allow the inspector freedom of movement.

Votan has been quite active in this market, says Bruce Ryon, manager of marketing communications. Voice output is already being used successfully by the handicapped. One famous example is the Kurzweil reading machine in which voice synthesis is used to read books to the visually impaired.

A key reason why vars are moving toward incorporating voice in their systems is economics, says Texas Instrument's Doug Palmer, product manager for TI Speech. Suddenly, applications that might have seemed like pie in the sky two years ago are affordable to market.

Costs have fallen dramatically over the last two years so that "we now have speech hardware that is reasonably priced," says Palmer. "When TI introduced the Speech Command System in 1983, the list price was $2,600; when we introduced our second generation system, TI Speech, in March of this year, the price had dropped to $995. The var can now supply an application on a system that is much more cost-effective than if he had to spend $2,600 on every speech board." TI has also worked to improve software development tools, he adds. "You can't just say 'here's text-to-speech'; you have to make it reasonably easy for a var to include text-to-speech in an application."

To encourage vars to use the speech units, TI has set up a special discount program for this product line, says Palmer, and has improved production of the units so they can be shipped multiple times without failing. To let vars know what they have to offer, TI shows up at American Voice Input/Output Society and Speech Technology trade shows.

Innovative Technology has selected Comdex as the show of choice to reach vars. Says Gary Hylton, director of sales and marketing for the startup company, "One of the unique ways we support our vars is through the inclusion of a simulation program written in C language that vars can port to any machine. They can then work up their applications and instead of worrying about having to test it with real telephones, they can run it in simulation." Innovative Technology has about 12 vars signed up right now. Hylton also notes that the firm offers telephone consultation time, some example applications, and access to ITI's DEC VAX computer for electronic mail, so that messages can be sent to its support personnel any time of the day or night.

Texas Instrument's Palmer says

Color output remains tied to specialty rather than general business applications.

that voice applications in the office have lots of room to grow. One especially promising area is in the inquiry of databases by people who are on the road a great deal and don't want to carry a computer terminal but do want access to data. "To be able to use the telephone as your sole device to access data will be really important," he says. DEC's Drinkwater points to electronic mail as another example. With voice-output devices installed on their computers, users who travel out of reach of a terminal can retrieve the text of electronic mail via the telephone: the system reads their messages to them.

ANOTHER GROWTH AREA

Computer training is another office automation growth area, Palmer believes, citing the example of Indiana Bell, now a Texas Instruments var that uses TI Speech in TI Professional Computers in training employees in its distribution department to use a mainframe program to assign service orders. Spoken instructions accompany the text. The personnel department found the voice application so successful that it developed and marketed an authoring system based on voice technology, says Dean Ellis, manager of personnel.

Ellis's experience is typical of the vars in this field who simply fall into the use of voice output rather than set out to design an application for it. "The dealer didn't know if it would work, and the people at TI in Texas said they would let me play around with a board for a while to see if it would work. It did," he says. The new economics of digitized voice and the good quality achieved were key to the system's success, Ellis adds. Users can recognize the voice accompanying the text, and the $995 board "more than pays for itself in the reduction of board and lodging required for a trainee to come to a central location and receive personal instruction."

Officials at Invocom in Hopkinton, Mass., began their experiments with this technology by providing voice mail systems through minicomputers, but quickly found that this field was very crowded. The solution: to branch out. Now Invocom is involved in selling IBM PC-compatible systems to banks and school systems. The banks use the voice-output devices to provide balance and other account information to their customers, while the school systems alert parents of children who have not shown up for class.

According to President Dan Perti, the company recently became a var for Innovative Technology because that firm provides more functionality on its board than its competitors. Perti also likes the fact that ITI has its boards made, tested, and shipped at a single original equipment manufacturer, eliminating some possibilities for reliability problems and the consequent finger pointing. The fact that the price of voice boards fell over the past two years has helped the firm remain competitive in what Perti views as an increasingly competitive market for voice. "We are really seeing a proliferation of suppliers of these systems and an increased awareness in possible applications for voice," he notes.

AutoComm of Santa Monica, Calif., is a TI var that began by addressing a specific application and then expanded. "Our software was designed around the TI speech board and transforms an IBM PC AT, XT, or compatible, or TI Professional or Portable computer into a speech management system," explains Cecilia Pfeiffer, vice president for sales. "The user keeps telephone directories to be called. A message, prerecorded through a microphone, telephone, or headset, is converted from analog signals to digital signals, compressed, and stored on hard disk until the message needs to be played back. The user selects the time for the AutoComm Messenger to start calling and a time to stop, and the unit works unattended."

The founders of AutoComm began by working with another TI var developing student administration software and found a need in school systems for mass calling of parents. Says Pfeiffer, "We wrote the design document at our former employer and wound up buying it from them and starting AutoComm." The firm started only in the education marketplace and has had excellent response from school districts and parents. "We do recommend that people do some public relations work in the community." A letter sent to parents informing them that the system would be used went a long way toward winning cooperation.

Price of the board really hasn't been a factor in selling the system, says Pfeiffer. This is because older, robotic tape recording systems that also do mass callings, but are not integrated into the computer and so can't access the database, tend to be higher priced. ◉

Based in Guttenberg, N.J., Esther Surden has written about the computer industry for 12 years.

PLOTTERS AND PRINTERS

by Dana Blankenhorn

Two truths in the world of printers and plotters are 1) color communicates better and 2) color printers and plotters have been around for years. In spite of these truths, the majority of the graphic output produced by American business today remains resolutely black-on-white.

That's changing. In fact, Peter Testan, who studies the color hardcopy market for research firm C.A. Pesko Associates Inc., Marshfield, Mass., calls 1985 "the year of color." He estimates total sales of color printers and plotters will increase to $5.96 billion annually by 1989, against $1.27 billion in 1984.

"By the end of 1985, there will be an installed base of over 1 million color hardcopy products in the U.S.," he adds. "This significant number of installed color hardcopy products will foster a color revolution in all areas of business and technical communications."

Testan's report is a call to arms for vendors of color plotters and printers, but Hedy Taub of Future Computing Inc. points out that, outside the scientific and engineering labs, graphics in American business is still a matter of black and white. In a study of printers completed last April, the Dallas-based market research firm commented, "We expected the 1985 market share for all color printers will be 4.7% of the total. In 1986, it will be 7.3%; in 1987, 11.1%; in 1988, 15.7%; in 1989, 20.5%; in 1990, 25.9%. This is in percentage of units sold, not dollar amounts." It doesn't take a colored graph to see that color output's future is all in front of it.

Why has color output still not caught on in America's executive offices? Until recently, color reproduction was stuck on the wrong side of trade-offs involving speed, resolution, cost, and standardization. Color ink jet printers could produce five to seven pages a minute, but their resolution was low and their prices high.

The same problem was seen in color dot matrix printers. Color thermal-transfer printers like the Okidata 10 and 20 were considered more capable, but also more prone to breakdowns. Color plotters produced high resolution, but worked slowly. Standards for communicating a color message between software and color printers did not exist in the real world.

Charles Muench has been around these trade-offs as long as anyone. A decade ago, he built and sold the first color computer, CompuColor. His PrintaColor Corp., a Norcross, Ga., company, makes color ink jet printers, and now his Colorocs Inc., also of Norcross, has a color copier ready for manufacuture. (Intelligent Systems Corp., another Muench-founded company, is a leader in color terminals.)

Muench believes a color copier is

It doesn't take a colored graph to see that color output's future is all in front of it.

the last link in the chain that can bring the whole business world into color. "It's reached the point of what comes first, the chicken or the egg. You can't have lots of color output unless there's a way to copy it. And there's not much demand for a color copier without color output to copy."

To get that color output, of course, you need a software driver that communicates with both the output device and your graphics software. Data Transforms Inc. in Denver sells a color graphics package called Fontrix, and vice president Duke Houston says each printer it works with still needs its own driver. "Some printers go with a byte that's horizontal instead of vertical. With each printer, you're looking at a different placement of dots," he notes.

"There are multiple ways of addressing all those little colored dots, and I don't think there's been any standardization," says Ed Juge, director of market planning for Tandy Corp., Forth Worth, Texas. "We have a color ink jet printer selling for $695, but it's not a hot seller because outside of a few packages we have that drive the thing, there's nothing out there." Unless a printer or plotter works with the applications businessmen already have, Juge adds, "businessmen won't buy them."

IBM'S PRINTER SOLUTION

When IBM announced its $745 Color Jetprinter last summer, the company tried a brute force solution to that problem with a list of compatible programs. IBM products like Chartmaster and outside products like Lotus's 1-2-3 and Ashton-Tate's Framework were on the list, says IBM spokeswoman Adrianne Singer. But only new versions of those products have the driver; owners of older versions must be upgraded to conform to Jetprinter specifications.

Before any software package can work with a specific printer, she says, "you have to look at the resolution of the printer. If you have printers with different resolutions, you must have a different driver. Different technologies, different resolutions warrant different drivers."

Another way to drive color printers is to install the driver in the operating environment. That, at least, is the promise of Windows from Microsoft Inc., Bellevue, Wash., and GEM from Digital Research Inc., Mountain View, Calif. Once these environments are configured to a printer, applications should run smoothly under them. Producing these programs has been much harder than talking about them, however. Both came out late, and GEM users were still burning up the phone lines to DRI with bug reports in September.

That leaves the option of putting the driver in the application. Common application packages like Lotus 1-2-3 are now being shipped with a set of drivers for common color printers and plotters. Lotus's drivers "will create an 8½-by-11-inch plot on any of our current drivers," says Margaret Lewis, manager of technical services for plotter manufacturer Houston Instruments, Austin, Texas.

This solution, however, is not perfect. "Some of our plotters use bigger paper, but Lotus doesn't let you use it," Lewis explains.

Another way to address the problem is by standardizing the hardware. "We've been working hard with our software vendors to get them to use our Digital Micro Plotting Language (DMPL), and it's been very successful," says Lewis. Over 250 software packages understand DMPL, she notes, including 1-2-3, and all Houston Instruments plotters use the same protocol.

Meanwhile, those hardware tradeoffs are becoming less onerous, as well. Plotters are getting faster, new printers have better resolution, and all equipment is getting less expensive. As a result, says Ray Habibi of Ace Computer Centers Inc. of Marietta, Ga., a Hewlett-Packard dealer, he's opening new plotter markets.

"This traditionally belonged to top-level executives in Fortune 100 corporations," Habibi says, "but now we see mom-and-pop type accounts getting in there. They find it a lot easier to show a pie chart than a whole lot of numbers."

There are still many choices that must be made in selecting a color output device, however, beyond choosing between a printer and a plotter. It it's a printer, do you want a dot matrix, ink jet, or laser printer? If it's to be a plotter, do you want a pen plotter or a new electrostatic plotter, which offers higher resolution and faster speed but at a much higher price? Often, the only way to sort through these choices is with the help of a value-added dealer or consultant, which raises the system's total price.

The choices can be bewildering, if sometimes beguiling. Plotters start at under $1,000 for products like Houston Instrument's single-pen DMP-40, going up over $20,000 for electrostatic plotters such as the Versatec ECP-42. IBM ink jet printers can be had for $745, and NEC dot matrix color printers cost even less. Perhaps the toughest task is to make a choice that will be supported by new software in the long run.

Bruce Thatcher, director of marketing for NEC, which sells only dot matrix colors printers in the United States, says improvements in quality will help those products win out over plotters. "We think resolution in the range of 300 dots per square inch is where the market will evolve, so that you can get very finely shaped characters and smooth, rounded surfaces."

SITUATION UNCHANGED BY 1990

Future Computing, which looked at the entire printer market—not just color—expects that laser printers, ink jet printers, and thermal-transfer printers will all gain in the next five years at the expense of dot matrix and solid font (typewriterlike) printers. Even in 1990, however, the question of which technology to use will still be open: solid minorities will still be buying each type.

Perhaps as a result of all this confusion, the business graphics market hasn't taken to color as its boosters might like. "To be honest, we're not selling too many of them," says Al Soskin, a store manager for Future Information Systems in Atlanta. "I don't think there's much of a market."

Soskin continues: "Let's take the average business. What do they use the printer for? Correspondence. Are you going to read a letter in red, green, and blue? I don't think you'd be happy with it. Black and white does the job every time, and it's less expensive.

"There are applications for color printers in CAD/CAM," he adds. "So yes, we're selling some HP plotters, and we do have the IBM Color Printer, but maybe we sell one per month," usually through a salesman specializing in engineering markets. "For those specialty vars, I could see a market." But not for business graphics.

Even among state-of-the-art users, color remains a frill. At Hayes Microcomputer Products Inc. of Norcross, Ga., color graphics are restricted to training and product development; printers in the executive suites are still monochrome.

So computer aided design remains the most popular application for business plotters. And pen plotters from Hewlett Packard and Houston Instruments have the leading market shares. (Even IBM sells the HP plotter on an oem basis.)

We're left with the statement we began with. Color communicates better. But how much color, in what form, with what resolution, on what software, and for how much? Before predictions of glory are realized, business users will demand answers to these questions. ◉

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